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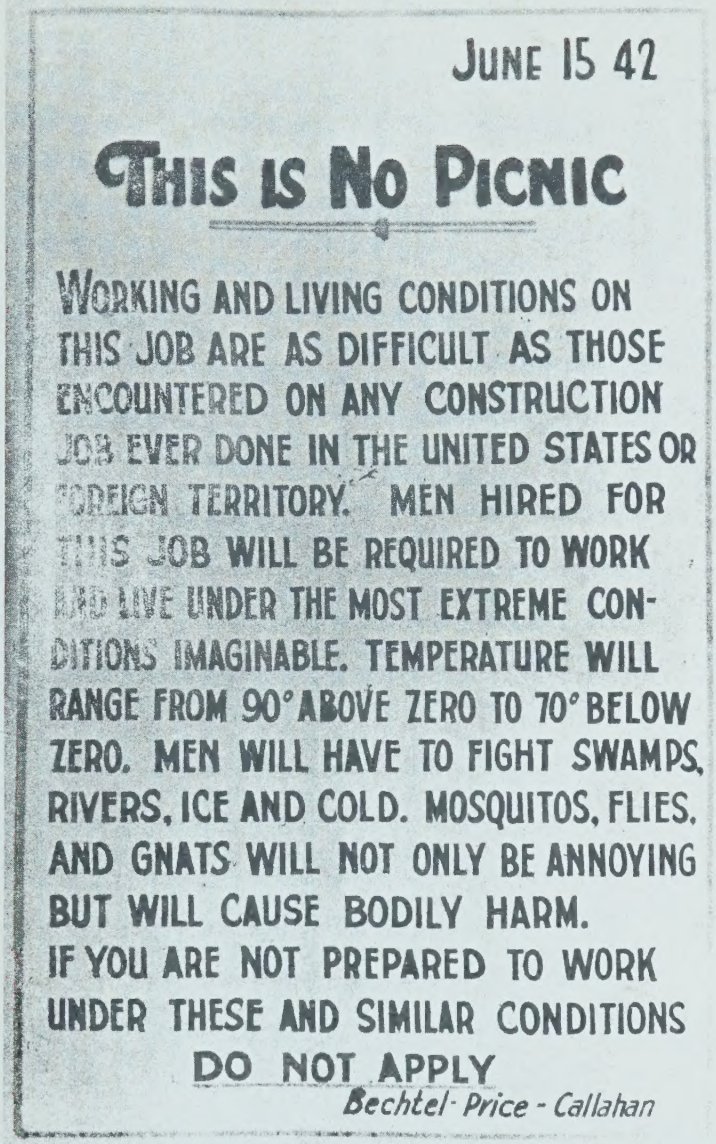
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THE CANOL PROJECT, NORTHWEST TERRITORIES

Prepared for

The Government of the Northwest Territories

Yellowknife, Northwest Territories

by

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Preface

The CANOL Project was a mammoth undertaking in the history of Canada and yet few people know of it and even fewer fully appreciate what it involved. There are three major reasons for this:

1. It was constructed during World War II as a military secret and therefore received little publicity.
2. It was short-lived, spanning only 37 months from its conception to its abandonment.
3. It developed into a political and financial embarasment to the Americans who had it built.

This document will discuss primarily the eastern section of the CANOL No. 1 Project. This is the protion that is within the Northwest Territories.

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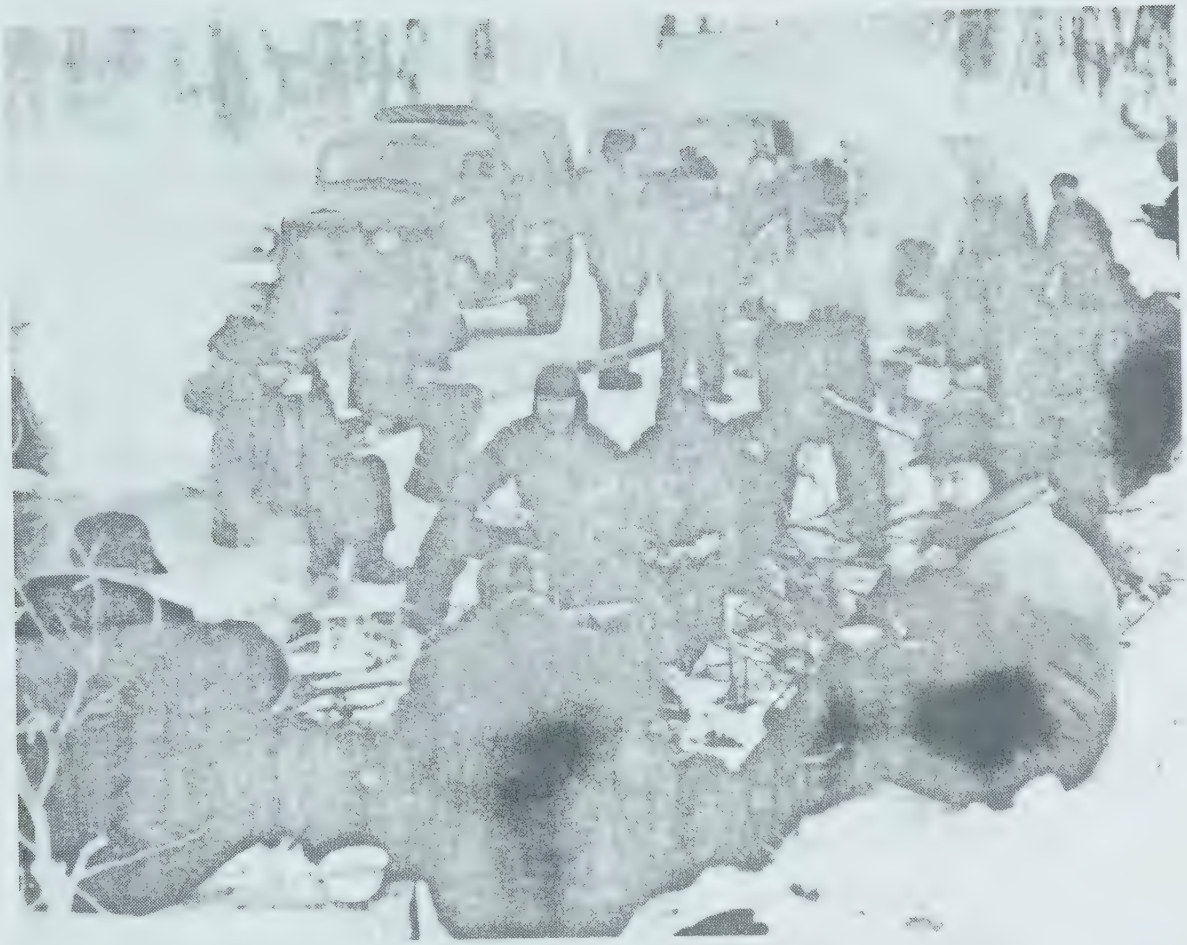


1. HISTORY OF THE CANOL PROJECT

1.1 PreCANOL: Aboriginal

Due to the lack of archaeological and historical research in the Mackenzie Mountains area little is known about the history of this region prior to European contact. Jenness' map for the 1725 period shows Hare and Nahanni tribes within the Mackenzie and Selwyn Mountains (Jenness 1977:378). These Indians lived a nomadic existence, relying on hunting skills to provide food and shelter.

Mackenzie called the Indian group utilizing the Mackenzie Mountains at the time of his voyage in 1789 the 'Mountain Indians' (Mackenzie 1801:Map). It appears that conflicts existed between the Mountain and Pelly Indians (about whom little is known) and Field documents a massacre which took place in 1886 (MacNeish 1957). The few survivors merged with Kaskas from the south to form the current mixed population of 'Pelly Indians' (MacNeish 1957:58) which is linguistically Tutchone.

These people had very little contact with Europeans prior to the establishment of Nahanni House in 1900. This was evidenced by their frightened reaction to their first encounter with the horse in 1913 and Sheldon's assertion that these 'Indians had been less in contact with white men than any other in the north" (Sheldon 1913:188–189).

During reconnaissance surveys in 1942, Guy Blanchet, Fred Andrew, Little Andrew Blondon and George Blondon noted locations where stone axes had been used to cut trees at old camp sites (Blanchet 1942:7,10). Fred Andrew from Fort Norman acted as guide, and using a map drawn by an old Indian from Fort Norman in conjuction with his own first hand knowledge of the area, guided Blanchet over the Indian trail to Sheldon Lake (Blanchet 1942, 1943, 1944; Thomson 1970a, 1970b)(Figure 1.1). It is evident from Blanchet's journal that Fred Andrew was familiar with the Divide region and that his people had used the area for many years, if not for centuries. The Fort Norman group moved on a seasonal basis into the mountains for winter hunting and trapping and then in the summer returned in moose skin boats via the Gravel (Keele) River to trade (Ebbutt 1931).

At the time of the CANOL Project route selection, surveyors relied upon native guides. It was this long history of use by native people in this area that provided the

escential information used to make the final route selection (Section 2.5.4.1).

1.2 PreCANOL: European

On 24 July 1789, Alexander Mackenzie noted "...pieces of petrolium [sic], which bears a resemblance to yellow wax ..." in the vicinity of the Ramparts, 110 km down river from Norman Wells (Mackenzie 1801:79). These seeps were the local supply of boat caulking and sealant for fur traders who followed the Mackenzie and for natives on the river (Kupsch 1971:134). In 1851, Fort Norman was established as a trading post for the Northwest Company (Stager 1971:53).

During the winter of 1897-98, at least one party of men heading for the klondike gold fields was guided through the Mackenzie Mountains and across the continental Divide by the Fort Norman Indians, thereby crossing the future CANOL right-of-way.

From 1 July 1907 to 20 July 1908, Joseph Keele, R.B. Riddel and J.M. Cristie conducted a geological reconnaissance along the Pelly, Ross and Gravel (Keele) Rivers and produced the first report and map of the Mackenzie Mountains (Keele 1910). In his report, Keele made reference to Charles Wilson, a prospector searching for the lost McHenry gold mine stating that:

> "A great deal of the country between the Macmillan and the headwaters of the Nahanni has been traversed in search of this lost mine"(Keele 1910:50).

On the Mackenzie River in 1911, Lewis Conibear, an engineer on the supply boat Ste Marie recorded that "Oil was floating in greenish-blue slicks on the water and here and there oozing from the river's bank" (Millen 1974:7). In the following year he staked claims for himself and his employer, the Oblate Fathers, but never registered them (Millen 1974:7). In 1911 J.K.Cornwall, a Northern Trading Company employee, hired an Indian named Karkesee to locate the source. Karkesee found several oil pools and brought back samples which were later analyzed and found to be similar to Pennsylvanian oil (Gray 1970:80). In 1914, T.O. Bosworth staked three claims for a Calgary syndicate at a site which had geological structures indicative of oil rich rock strata and in 1918, these claims were purchased by the Northwest Company, a subsidiary of Imperial Oil Company Limited (Gray 1970:80).

In September of 1919, a geologist named Ted Link arrived at Norman Wells with a drill crew, a cable tool drilling rig,. supplies and an ox. By midwinter the 'one ox-powered drill' had penetrated 30.5 m and encountered the first showing of oil. On 23 August 1920, more oil was encountered at 213 m and at 239 m oil gushed to a height of 21 m for 40 minutes, proving the richness of the find (Gray 1970:82-83) (Plate 1.1). This was the "first major oil field found in Canada since Williams had opened the Ontario field in 1857"(Imperial Oil Limited 1977:3). News of the discovery spread and in the winter of 1920-21 there was an oil claim staking rush at Norman Wells with dog teams arriving from as far away as Edmonton (Millen 1974:9).

Imperial Oil Limited erected a refining still in 1921 which was capable of processing 200 barrels of crude oil a day to produce motor gasoline and diesel fuel (Public Archives of Canada RG36/37 Vol.2 file 3/5). The refinery was active for only one season due to the lack of a market plus high operating costs (Imperial Oil Limited 1977:3).

In 1930, silver and uranium were discovered by G.A.LaBine on Great Bear Lake and in response to this new market, the Norman Wells refinery was enlarged with a steam still, skimming plant capable of processing 500 barrels daily (Finnie 1943a, 1959; Imperial Oil Limited 1945:3, 1977:3; Kupsch 1971:135). The present refinery was in operation on a seasonal basis by 1933 (Imperial Oil Limited 1977:3). In 1940, two new producing wells were brought in and during 1941 "production was a little less than 24,000 barrels of high and low-test gasoline and several grades of oil" (Finnie 1943b:13).

By this time the only map of any portion of the Mackenzie Mountains was that produced by Keele (1910). No aerial photographic coverage was available for what later became the CANOL route. No aircraft had ever flown between Whitehorse and Norman Wells and native people no longer utilized the Macmillan Pass and Continental Divide region. The area between the upper Ross River and the Mackenzie River was virtually unknown and essentially unexplored.

1.3 CANOL 1942-1945

1.3.1 Introduction

In the July 1941 issue of *Foreign Affairs*, Vilhjalmur Stefansson suggested that a winter road and/or pipeline be built between Norman Wells and the head of navigation on the Stewart River in the Yukon. He maintained that oil trucked or pumped over this route could be distributed during the navigation season throughout the Yukon River basin in the event of a military necessity (Stefansson 1941). That possibility became a reality on 7 December 1941 when the Japanese attacked Pearl Harbour. By June 1942, Attu, Kiska, Shemya, and Amchitka (all Aleutian islands) were occupied (Anon 1980). Hong Kong and Singapore had also been taken. Japanese submarines had shelled a refinery in California and shipping losses were heavy with tankers becoming scarce. On 20 April 1942 the U.S. "...military authorities made the decision to take advantage of known oil resources in northern Canada for supplying the Alaska Highway and related installations"(Truman Committee 1944a:9551). Five days later Brigadier General Walter B. Pyron, a U.S.Army petroleum expert, received information from Stefansson concerning Canadian sources of oil (Finnie 1959). On 29 April 1942 a two-hour meeting was held with representatives of I.O.L. and Standard Oil of New Jersey (Truman Committee 1944a:9843-9844). From this, J.H. Graham, Dean of Engineering, University of Kentucky, compiled a one page memorandum which was signed that day by Lieutenant General Brehon B. Somervell, Commanding General, Services and Supply, U.S.Army. The following day, Imperial Oil Limited and Standard Oil of New Jersey ratified an agreement with the U.S.Army and CANOL was launched (Truman Committee 1944a:9845).

By 1945 there were 7 CANOL Projects in operation. They included docking facilities, barges, tugs, 25.8 km of portage, 2,736 km of water routes, 320 km of summer and 483 km of winter roads around the oil fields, 8 landing strips, 2,415 km of winter roads, 763 km of new all weather road, 2,512 km of pipelines, 763 km of telephone lines and a crude oil refinery (Table 1.1) (Figure 1.1). The initial directive by Graham did not foresee the extent of the necessary ancilliary projects, nor did it allow for the preparation necessary prior to construction. A chronology of CANOL No. 1 and related events is presented in Figure 1.2.

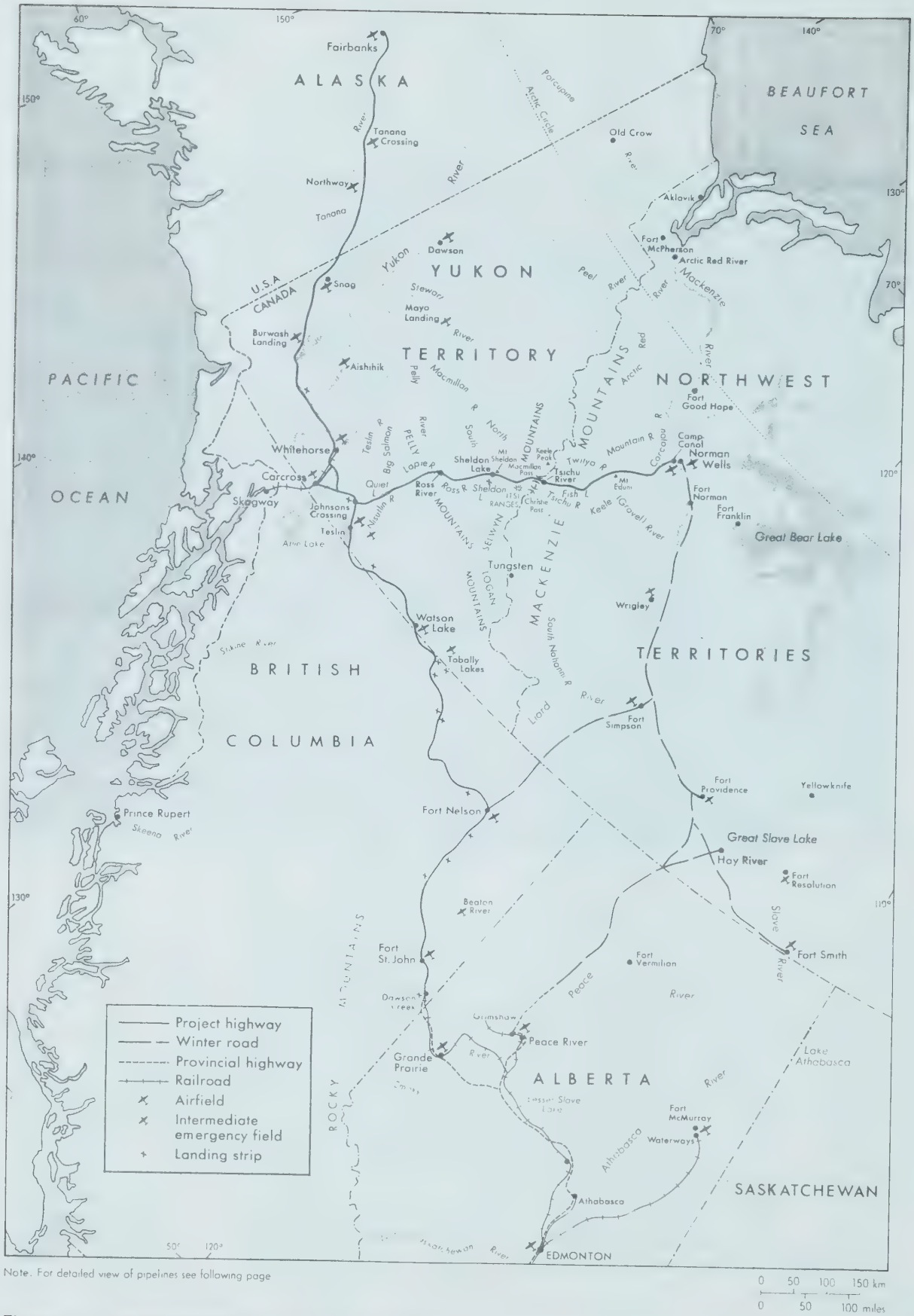
Plate 1.1 Discovery Well at Norman Wells, August 1920 (courtesy of the Public Archives of Canada, Neg. C36396).

Table 1.1: CANOL Projects

CANOL No.	Project Description	Initial Directive for Date of Completion	Date of Construction Initiation	Date of Construction Completion	Date of Abandonment/ Cancellation
		(where dates vary from one source to another, all are included)			
1	a) Water routes: Docking, portaging, barging and tugs for 1,884 km	15/VI/42	VI/42	end 42	some still used
	b) Mackenzie air route: 8 landing strips	?	?	end 42	some still used
	c) Winter road: 402 km from Fort Nelson to Fort Simpson	?	I/43	I/43	some still used
	d) 1.Tote road:763 km graded, unsurfaced, fine weather road from Norman Wells to Whitehorse	?	10/IX/42	31/XII/43*	30/VI/45
	2.All weather road: 763 km gravel surfaced, maintained road from Norman Wells to Whitehorse	?	10/IX/42	15/X/44+	30/VI/45
	e) Telephone line: approx. the same distance as the road	?	VII/43	10/III/44	30/IV/45
	f) Crude oil pipeline: 10.2 cm line for 737 km and 15.2 cm line for 192 km, welded from Norman Wells to Whitehorse	15/X/42	31/X/42	19/XII/43 (first filled)	13/III/45
			14/VI/43	16/II/44	30/IV/45
	g) Refinery: Whitehorse	I/X/42	?	?	I/IV/45
	Total CANOL No.1 Project	31/VII/42•	?	?	31/III/45
2	Products pipeline: 10.2 cm for 177 km welded pipe from Whitehorse to Skagway	?	18/VII/42	29/XI/42	6/VI/46
3	Products pipeline: 5.1 cm for 430 km, screw jointed pipe from Whitehorse to Watson Lake	?	20/IX/42 (contract let)	16/VI/43 24/VII/43	I/X/45
4	Products pipeline: 7.6 cm for 976 km welded pipe from Whitehorse to Fairbanks	?	22/IX/42	31/VII/43 (first filled) 23/II/44	14/VII/46
5	Products pipeline: Fairbanks to Tanana	25/IX/42	?	cancelled	V/43
6	Winter road:Tractor trail for 1,610 km from Grimshaw to Norman Wells and 322 km from Fort Simpson to Hay River	winter of 42/43	2/X/42	15/VII/42 24/II/43 23/VII/42 I/43	snow-melt 1943
7	Well drilling roads: 322 km summer roads and 483 km winter roads in the Norman Wells area	?	?	?	some still used
8	Tug boats and barges	break up 1943	?	?	?

* tote road complete but all-weather road still under construction when project abandoned
+ major maintenance was continually necessary to keep the road open, even up to the time of abandonment
• date changed to 31/XII/43 in VII/42

(after Finnie 1947; Hemstock 1945; U.S.Army 1950)



Note. For detailed view of pipelines see following page

Figure 1.1 Northwestern Canada and Alaska, joint defence construction projects, 1944

CANOL No. 1 Canol to Whitehorse - pipeline, all weather road, telephone

○ Pump station

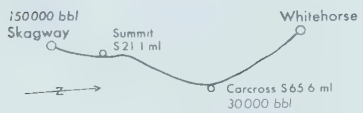
100 bbl Barrels

S100 ml Miles from Skagway

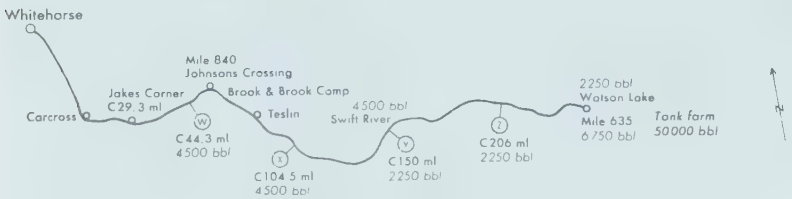
C100 ml Miles from Carcross

W100 ml Miles from Whitehorse

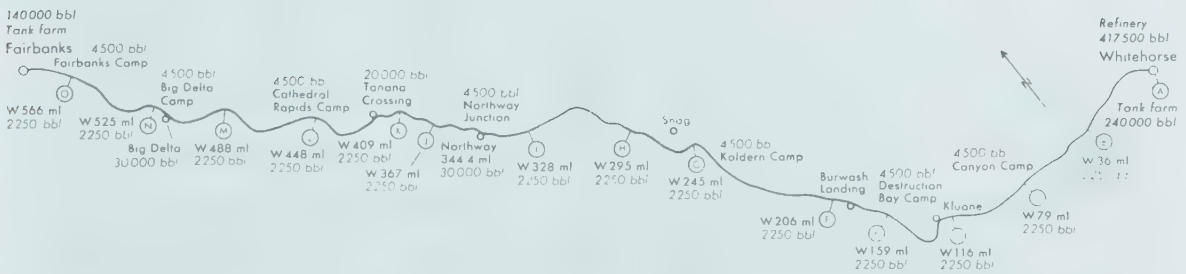
CANOL No. 2 Skagway to Whitehorse - pipeline, railroad, telephone



CANOL No. 3 Whitehorse to Watson Lake - pipeline, highway, telephone



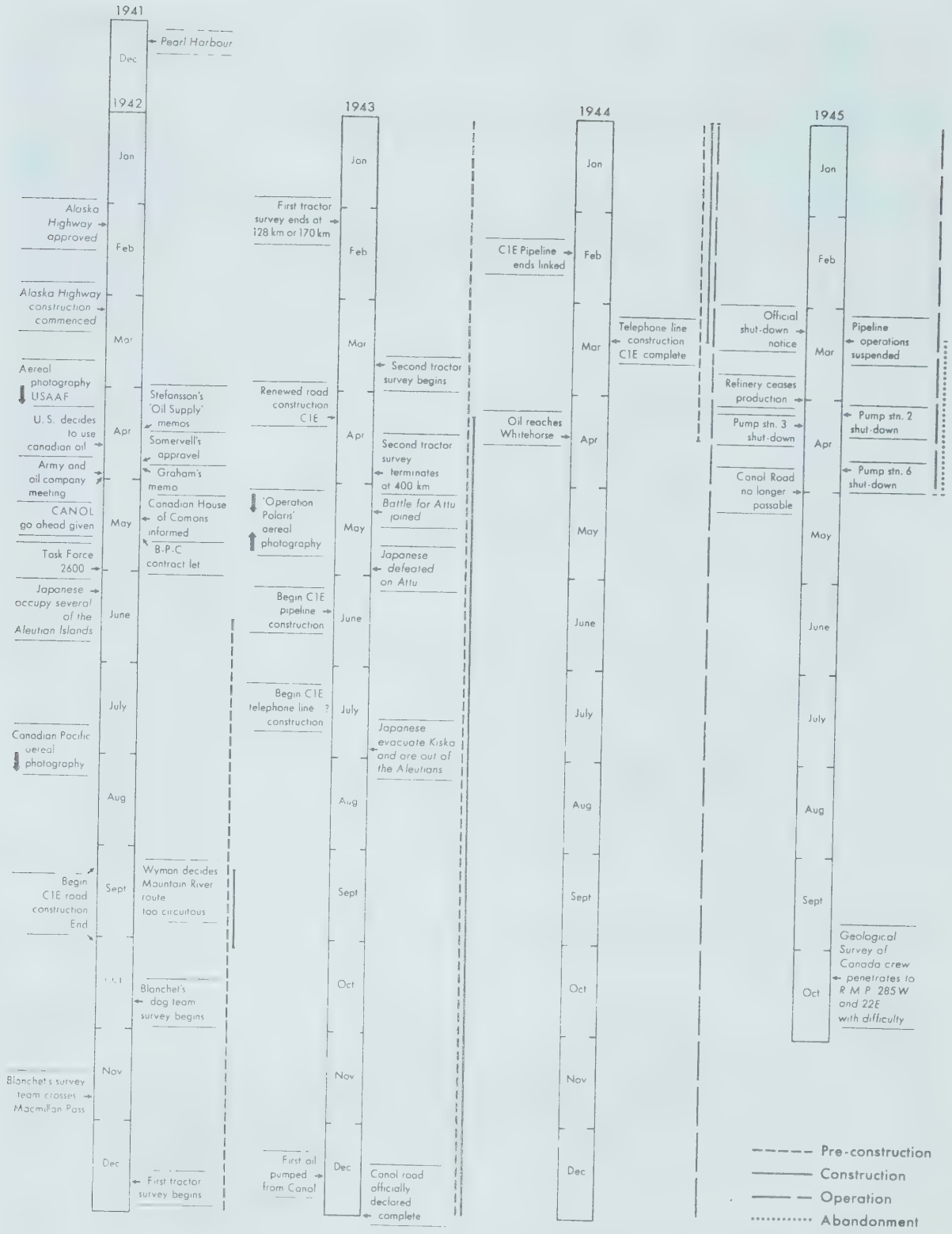
CANOL No. 4 Whitehorse to Fairbanks - pipeline, highway, telephone



CANOL No. 6 Grimshaw to Norman Wells - winter road (see main map)

After Imperial Oil Ltd. 1944

Figure 1.1 continued



Note: Overlap of the pre-construction, construction, operation and abandonment phases occurs since not all the parts of the project were completed simultaneously.
C1E - short for CANOL Pipeline No. 1 East, the Northwest Territories section

Figure 1.2 A chronology of CANOL No.1 and related events

1.3.2 Initiation of Events

A contract between Bechtel–Price–Callahan (B–P–C) and the U.S. Army for the design and construction of the crude oil pipeline and refinery was drafted on 4 May 1942 and signed on 20 May 1942 (Finnie 1945b:4). A total of $25,000,000 was requested from the U.S. Bureau of Budget.

On 15 May 1942, the Canadian House of Commons was informed of the CANOL Project (Unrevised Hansard 15 May 1942:2696) and on May 16, the War Committee of the Cabinet approved the project and granted permission to proceed (Department of National Defense Archives DND348.013 D2). As part of this agreement, the United States was given exclusive rights to the hydrocarbon resources of all of the Yukon Territory and Northwest Territories west of the Mackenzie River and a corridor along the Mackenzie River valley extending up to 150 km east of the river (Figure 1.3).

On 26 May 1942, Task Force 2600, consisting of 2,500 men, was activated under Colonel Wyman's command. By 2 June 1942, men began to arrive at Waterways and soon materials were being readied to move north along the water route. On 4 June 1942, Standard Oil made a report stating that CANOL could not be completed on schedule and recommending the shipping of finished fuel products from the south to the Northwest since it would be "... many months before the CANOL Project could be completed"(Truman Committee 1944b:4).

1.3.3 Ground Route Reconnaissance

Guy Blanchet, an experienced land surveyor, was hired by B–P–C to plot the pipeline route (Finnie 1947b). On 6 June 1942, interviews with Fort Norman Indians indicated that an Indian trail through the Mackenzie Mountains might be preferable to a Gravel River route. On 12 June 1942, the first flight over the Mackenzie Mountains was completed and Blanchet later conducted several aerial reconnaissance flights.

Construction of Camp Canol began across the river from Norman Wells and "road construction was started from this point and survey extended towards the Mountain River route"(Blanchet 1943:19). On 25 October 1942, Guy Blanchet set out with a crew of 6 men and 25 sled dogs along the Indian trail to Sheldon Lake (Plate 1.2). The route blazed by this team along the 'Indian road' was primarily that followed by the CANOL

Plate 1.2 The Blanchet survey team near the head of Dodo Canyon (November 1942, courtesy R.S. Finnie).

Project. On 21 November 1942, the survey party passed through Macmillan Pass, crossing over the Continental Divide into the Yukon. Reconnaissance surveys by tractor train [1] set out from Norman Wells on 22 December 1942 and on 23 March 1943. These excursions penetrated up 170 km and 400 km respectively (Plate 1.3). The many difficulties encountered on these surveys are summarized as follows:

> "Diesel fuel froze to the consistency of vaseline, and would not pour. Light motor oil became as hard as cup grease. The best grade of anti-freeze solid in the tins. ... Sleigh runners scraped on the jagged surface and wore out in no time.
>
> Sometimes tractors stopped as often as every fifteen minutes. Intense cold caused condensation. Condensation caused ice. The ice lodged in the fuel system and cut off the fuel supply ..
>
> The cold rendered the sleigh runners as brittle as cast. Time after time they broke. ..
>
> Motors had to be kept running twenty-four hours a day. To stop a motor once and let it get cold meant stopping it for good" (Meyers 1945:18).

These ground reconnaissance surveys established the general route of the CANOL Project. However, a number of alternatives (Finnie 1947a.216-218) were considered before the route was finalized only months before the joining of the rights-of-way on the Mackenzie Mountain Barrens. Maps and aerial photographic coverage of much of the area were not completed until after the project was operational.

1.3.4 CANOL No. 1 East: Construction

1.3.4.1 Road Construction

On 10 September 1942, road construction on CANOL No.1 East commenced at Camp Canol (Plate 1.4) (Yukon Archives NNG75.93 No.13). In December 1942, the decision was made to cease construction until "it should be established that much more oil than has been located as yet is available" (Public Archives Canada RG2,7c Vol.7-17 Roll C-4875; RG24 Vol.2639).

---

[1] Tracked vehicles travelling in convoy with sledded freight carriers and living quarters in tow.

Plate 1.3 The tractor train survey which penetrated almost to the Continental Divide at Fish Lake. One of the wanigans pictured here still remains at the lake, which is 13 km from the Canol Road (April-May 1942, courtesy R.S. Finnie).

Plate 1.4 Camp Canol on the Mackenzie River was capable of housing 2500 people (photo by R.S. Finnie).

Renewed road construction began from the eastern end on 12 April 1943 (Yukon Archives NNG75.93 No.13). Forty-eight per cent of the 826 km of road construction on CANOL No.1 East was completed during the winter of 1943-1944. Although the construction crews from the east and west met on 31 December 1943, road construction activities continued until the termination of the Project in March, 1945. Officially however, any work carried out after 15 October 1944 was considered maintenance (Public Archives Canada RG24 Vol.2639). The following quote gives some idea of the scope of the road construction.

> "In addition to the construction of road and surfaceing thereof (for 180 miles), 65 pile driven bridges had to be built. This meant cutting of piling timbers and decking in job site saw mills and handling of same over roads which were almost impassable. Eight hundred and twenty culverts, with sizes ranging from 18 to 60 inches were required. From six hundred and fifty thousand to eight hundred thousand cubic yards of borrow were estimated as necessary for surfacing and filling. Four hundred thousand cubic yards of gravel surfacing were required. It is estimated that in addition to the above mentioned new construction, 250 miles of new surfacing were required. This is in addition to spot surfacing, which was necessary in places showing weakness during and following the breakup"(Yukon Archives NNG75.93 No.16).

The main concerns during construction were engineering problems and efforts to minimize the time required to complete the Project. Initially construction practices were the same as those employed in more southerly areas, with supervision by engineers trained in the south and with only southern experience. However, ice-rich permafrost was present in many areas along the route and on the Mackenzie Plains the road crossed 37 km of such terrain.

> "On the location of the road it is impossible from surface indications to determine the class of digging that will be found, in addition to the fact that the entire area is over permafrost, conditions as to seepage, slides, and ice cap [icings], can only be handled as they are met. In numerous cases back up and relocations for considerable distances have been necessary to by pass

unstable ground not apparent at the time of location or which developed after the ground was exposed to air" (Grafe 1943:31).

With experience, practices familiar to people working in permafrost areas came to be employed.

During construction, D-8's usually pulled two 'cabooses' or 'wanigans' which were portable buildings used for all camp activities. They served as mess halls, work sheds, storage and parts rooms or bunk houses, each holding eight men. These cabooses were mounted on steel shod sleds and dragged by bulldozer to line camp sites. Emergency shelters were located along the road at intervals from 5 to 16 km so that drivers would not be marooned without shelter in the event of a mechanical breakdown.

The completed Canol Road East was 372 km in length. Road maintenance crews were stationed at camps at R.M.P. 0, 36.5, 50, 74.5, 80.5, 100, 108, 132, 170, 201, 208, and 222.

1.3.4.2 Pipeline Construction

Feeder lines within the Norman Wells oil field were the first pipelines of the CANOL Project. The pipeline crossing of the Mackenzie River was completed 31 October 1942 (Finnie 1943b:40) and due to breaks, it was shut down 20 November 1942 (Public Archives Canada RG24 Vol.2638). On 14 June 1943, construction of the 10.2 cm CANOL No.1 East main pipeline commenced (Yukon Archives NNG75.93 No.13). At 2:30 h on 19 December 1943, with 177 km of the pipeline welded, the first oil was pumped into the pipe. At 13:55 h that afternoon, the first oil spill occurred at R.M.P. 18 as a result of pipe that had been damaged by a telephone crew tractor (Yukon Archives NNG75.93 No.11). Seventy per cent of the construction on CANOL No 1 East was completed during the winter. On 16 February 1944, the eastern and western ends of the pipeline were joined at R.M.P. 281.5W/R.M.P. 231.8E (Finnie 1947a: 399-400, Yukon Archives NNG75.93 No.11). Figure 1.4 depicts the completed CANOL Project in early 1944. Oil flowed through Macmillan Pass some time between 12 and 20 March 1944 and reached Whitehorse on 16 April 1944 (Finnie 1945b, Public Archives Canada RG36/37 Vol.48) (Plate 1.5). Eleven months later, on 8 March 1945, the U.S.Army issued an order to stop putting oil in the line since the project was to be terminated (Department of National Defense Archives DND348.013 D1; Finnie 1947a:402, Public Archives Canada RG24

Plate 1.5 The completed CANOL No. 1 pipeline was above-ground and often close to the tote road (photo by R.S. Finnie).

Plate 1.6 The pump stations were generally 30 to 35 miles apart. Pump Station No. 6 was at Mile 208E and is depicted here while under construction (photo by R.S. Finnie).

Vol.2639 and RG36/37 Vol.6). On 1 April 1945, the refinery ceased operation, having exhausted its stockpiled crude oil supplies (Yukon Archives NNG75.93 No.16).

At least 44 line breaks occurred prior to completion of the line (U.S.Army 1950:46). However, no information is available regarding the quantities of oil involved.

The CANOL No.1 East pipeline was 357 km in length and had 6 pump stations (Plate 1.6):

1. Pump Station No.1 at Camp Canol (R.M.P. 0)
2. Pump Station No.2 at R.M.P. 36.5
3. Pump Station No.3 at R.M.P. 74.5
4. Pump Station No.4 at R.M.P. 100
5. Pump Station No.5 at R.M.P. 170
6. Pump Station No.6 at R.M.P. 208

Each station had a pumphouse, storage tank, light plant, mess hall and dormitory and several had additional facilities. A crew of five, including one head operator, three operators and one roustabout, was necessary to operate each station.

1.3.4.3 Telephone Line Construction

Telephone line construction began at Camp Canol in July 1943 (Public archives Canada RG36/37 Vol.2 File 3/9). The line was in place eight months later on 10 March 1944 and was operating 17 days after that. Twenty-four per cent of the CANOL No.1 East telephone line was complete by November 1943 and the remainder was finished during that winter. The construction was labour intensive and tractors were used only occasionally. Flood's journal (1946) describes pole erection by hand and movement of poles from the road to erection sites by horses. The excavation of holes was mainly by hand with dynamiting in ice-rich areas.

> "We are having to blast nearly every hole. Most of them are frozen in quicksand, and the blast, to penetrate anywhere deeply enough, has to rip out a regular cavern at the top. The hole my partner and I were on this afternoon was six feet in diameter and three feet deep. We still have to go two-and-a-half feet, and probably will have some hard and slow chipping with the bar near the bottom"(Flood 1946:27).

The telephone system was similar in length to the pipeline, with U.S.Army repeater

stations at Pump Station Nos. 1, 4, 6, 7, 8, and 10 and at Brooks Brook (Figure 1.1). Each station employed three repeater men and two line men and a roving crew of five was also kept on the system (Hemstock 1945:17).

1.3.5 CANOL No.1 East: Operation

Maintenance of the pipe and telephone lines was carried out from the road which parallelled their rights-of-way (Plate 1.7). The Canol Convoy headquarters in Whitehorse employed 50 men (presumably the majority of these were drivers) with 40 others responsible for vehicle maintenance (Hemstock 1945:18) (Plate 1.8). Hemstock recorded that:

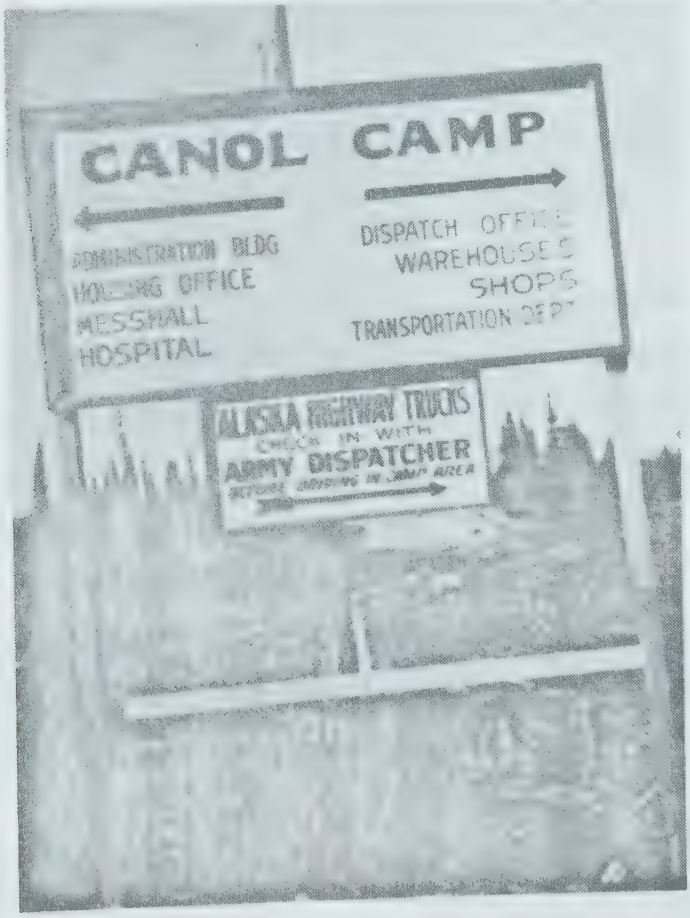
> "On the section of road from Canol to Johnson's Crossing, 22 trucks equipped with snow plows were in use during January and February. In addition 15 Galions and 15 D-8 Caterpillars with bulldozer blades were used for snow removal. 15 trucks were in use for glacier control [icings] and 7 were used to handle the portable boilers"(Hemstock 1945:15).

In the spring, the poor condition of the road rendered it impassable. In summer, dust was a major problem for traffic on the road. Truck convoys on the narrow, twisting road posed a special hazard.

Oil was pumped in CANOL No.1 for a total of 16 months from 19 December 1943 to 1 April 1945. Although oil entered the pipe at Camp Canol in December 1943, it did not reach Whitehorse until 16 April 1944. Delays resulted from construction problems and the time needed to test the pipe for weaknesses. In addition to this, an estimated 27 days was required to fill the pipe (Yukon Archive RG338 No.4). Oil deliveries were made to Whitehorse for the 331 days from 16 April 1944 to 13 March 1945 (U.S.Army 1950:42). Between July and November of 1944, the project provided all of the motor gas requirements for military needs between Watson Lake and Fairbanks and also exported between 136,000 and 244,000 barrels from Skagway. It was projected to produce 53 % of the annual aviation fuel requirements of the local traffic and of some 40,000 lend-lease aircraft which were flown over the staging route to Siberia (Yukon Archives RG338).

Plate 1.7 On the Mackenzie Mountain Barrens there are a number of barrel dumps that remain intact today. The pipeline lies on the ground near the telephone line to the right of the road (photo by A.E. Porsild, courtesy of the National Museums of Canada, September, 1944).

Plate 1.8 Camp Canol included the first pump station and the eastern terminus for the Canol Truck Convoys that supplied all the CANOL No. 1 camps throughout the year (photo by A.E. Porsild courtesy of the National Museums of Canada, September 1944).



Of the oil pumped into the pipeline, 14.6 % was potentially spilled This includes 5.2 % that was left in the pipe and in storage tanks along the line at the time of abandonment. The remaining 9.4 % (108,857 barrels) was presumed to be spilled during construction and operation of the line and of this, 42 % (46,108 barrels) was recorded with reasons for the various breaks (Hemstock 1945). A summary of the CANOL No. 1 pipeline operation is presented in Table 1.2.

1.3.6 CANOL No.1 East: Abandonment

Evacuation directives were issued on 8 March 1945 and the Canol Road East was closed by 24 April 1945. Abandonment was completed prior to spring breakup in order to avoid the delay and maintenance costs associated with keeping the road open during and after spring thaw. Of equal and perhaps greater importance was the fact that the War Department appropriations for CANOL expired 30 June 1945, and in the words of one official

> "...it is not possible, in the view of the changing military picture in Europe and domestic political considerations that Congress may refuse to provide funds for its continued operation.." (Public Archives Canada MG26 J4 Vol.243 File 2461).

Evacuation moved from the Mackenzie River westwards, centering on road maintenance camps and pump stations. Buildings were cleaned and secured, leaving sufficient equipment on site to reactivate the project, should it be desired.

1.3.7 CANOL No.1 East: Salvage

With the abandonment of the CANOL No.1 Project in 1945, road blocks were established to restrict access along the Canol Road. Imperial Oil Ltd. acquired title to the assets of the United States Government at Norman Wells for $3,000,000 in September 1945 (Public Archives Canada RG36/7 Vol.2). In 1947, having aquired the salvage rights to the CANOL No.1 Project for less than $1,000,000 (Phillips 1967:151; Karamanski 1979:21), a Pennsylvannia-based salvage firm, L.B.Foster Company (Public Archives RG35 B3 Vol.2126), began removing machinery and pipe from the CANOL No 1 line George Prince from Dawson Creek, British Columbia subcontracted to do the work (Public

Table 1.2: Summary of CANOL No.1 Pipeline operation (barrels)

Date	Total Pumped From Canol	Total Received At Whitehorse	Total Accounted For At Pump Stations	Pipeline Inventory	Total Unaccounted For	% Of Total Pumped
1943						
December 19	4,652	0	ND		ND	
1944						
January	10,458	0	ND		ND	
February	6,827	0	ND		ND	
March	35,554	0	ND		ND	
April	98,053	45,489	ND		ND	
May	81,890	76,399	ND		ND	
Sub-total	237,434	121,988	4,000(est.)	66,964	44,482	18.7%
June	89,725	81,723	758		6,718	7.5%
July	69,322	57,535	1,020		8,552	12.3%
August	89,801	78,963	1,015		11,300	12.6%
September	69,590	61,468	936		9,103	13.1%
October	117,589	109,406	1,084		5,805	3.3%
November	109,824	97,027	1,777		9,224	8.4%
December	106,834	93,324	2,326		5,584	5.2%
1945						
January	120,967	118,448	2,248	Stor. 8,979 Pipe 62,430 Totl 71,409	3,863	3.2%
February	106,571	102,287	2,691		4,226	4.0%
March	43,737	49,685	2,553	60,275	ND	
Total	1,161,394	971,685 (83.7%)	20,408 (1.8%)	60,275 (5.2%)	108,857 (9.4%)	
Total Potentially Spilled		108,857 + 60,275 = 169,132 (14.6%)				

'ND' no data available

Archives Canada RG35 B3 Vol.2126) and was conducting salvage operations into November 1948. In 1949, Ray Hade and Tom Rimmer from Westlock, Alberta acquired the salvage rights (Anon 1970:39). Mr. Rimmer took over the operation on the eastern end of the Project in the summers of 1952-1953 and possibly in 1951 (Bill Kochan, personal communication 19 September 1978) removed pipe and machinery from that area (T.Rimmer, personal communication 1978; W.J.Cody, personal communication 1979).

The U.S.Army planned to sell the CANOL Project to the highest bidder, assuming that the new owner would reactivate it. However, this was not to be the case and instead much of the oil left in the line was spilled during salvage operations. The vehicles, construction machinery, pump station installations and pipe became the main focus of salvage operations. No attempt was made to rehabilitate any of the CANOL disturbances. Although a number of pipe sections still remain, most of the line is gone. Vehicle dumps, barrel caches and camps remain on site, despite the numerous official and unofficial salvages that have been carried out since 1945 (Anon 1970; Synergy West Ltd 1975).

2. NATIONAL SIGNIFICANCE OF THE CANOL PROJECT

2.1 Major Contributions of the CANOL Project

The CANOL Project was an historic event of national significance. It directly affected most of northwestern Canada (i.e. the area north and west of Edmonton, including northern Alberta, northern British Columbia, all of the Yukon Territory, and the Mackenzie region of the Northwest Territories. The size of the project and the nature of its environment both contribute to the national significance of CANOL. At the time, CANOL was one of the largest projects of its kind and was certainly unrivalled in the north. When compared to the Alaska (ALKAN) Highway for example, it was longer, affected a larger area, employed more workers and cost more to construct. The CANOL Project involved 2,740 km of water routes, 3,985 km of winter and summer roads, 8 landing strips and 2,512 km of pipelines. There were 30,000 men employed during its brief history and it is estimated to have cost between 130 and 300 million 1942 dollars (Plate 2.1). Bechtel Corporation was a relatively young company at the time and its success in becoming one of the world's most important pipeline companies was related to its involvement with CANOL.

CANOL stimulated the first aerial photography of much of the area between Edmonton and the Beaufort Sea (1943). In the Northwest Territories this photography was used to compile the first detailed maps of the area west of the Mackenzie River (i.e the Mackenzie Mountains) and many of these maps remained unsurpassed until the 1950's. On the ground, exploration and mapping of the region was carried out for the first time, following historic Indian trails, on foot initially and then by tractor train. This resulted in the charting and naming of many of the rivers and mountain ranges in this part of Canada (Kershaw 1981). The routes initially surveyed were changed several times before completion of the project but evidence of the original surveys still remains (i.e Plate 1.3). The surveyors were probably the first Europeans to traverse this route through the Mackenzie Mountains and Macmillan Pass.

CANOL was a major engineering feat, carried out at a time when little was known about the unique environmental limitations governing development and exploitation of northern resources. Some of the problems encountered included: ice-bonded

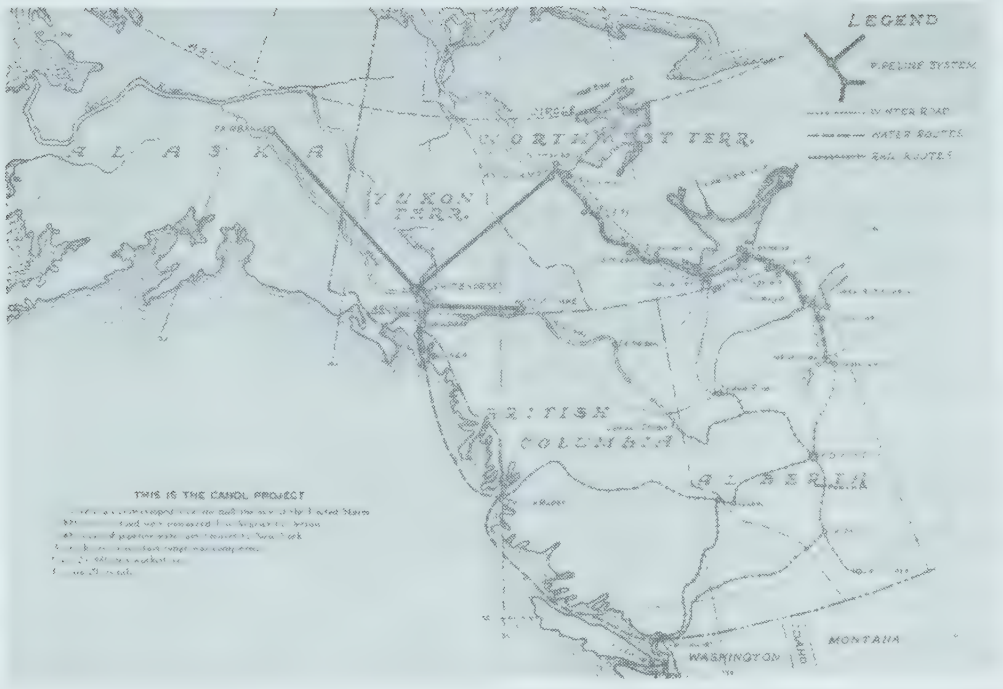


Plate 2.1 This map is an example of the unauthorized publicity that CANOL received during the latter part of the War (Meyers C 1945). Although some of the values are in error it does demonstrate the scale of the Project.

permafrost; shock sensitive soils; short thaw season, severe winter climate (blizzards, extremely low temperatures, short day length); forest fires and smoke; insect pests; great length of necessary supply lines; lack of communications facilities (no telephones, roads of landing strips plus interference of radio communications by the aurora borealis).

Ironically, the construction period of 22 months was longer than the operation time of much of the CANOL Project (e.g. CANOL No.1 operated for only 11 months). However, the Norman Wells oil field, delineated by the 58 wells drilled for the U.S. Army will now be supplying oil and gas to the Norman Wells pipeline which has been approved and will soon be under construction. However, other components of the Project were longer lived. CANOL No.2 operated continuously until 1946 and after a shutdown, has since been reactivated.

Many Canadians were involved in the CANOL Project. Civilians participated in all phases and included the following: bush pilots, guides and surveyors selecting the routes; general labourers, equipment operators, skilled tradesmen (i.e. welders, electricians, plumbers, carpenters), and engineers during the construction period, maintenance crews and pipeline operators during the operation phase. Even the salvage crews following abandonment were composed predominantly of Canadians. However, during the initial stages of the CANOL Project, United States citizens comprised the majority of the labourers. This included the employment of the 2,500 man U.S. Army Task Force 2600.

The CANOL Projects were designed to provide a militarily secure, inland supply of petroleum products. It was originally conceived to provide for the fuel needs of the war effort in northwestern Canada and Alaska. At that time successful Japanese attacks had been made at Pearl Harbour and islands in the Aleutians had been occupied. The full potential of the CANOL Project was never developed due to the successful operations of the Allies in the Pacific theatre of the war. The rational for CANOL disappeared within months of the decision to proceed and a secondary objective, to provide aviation fuel for the lend-lease aircraft on their way to the U.S.S.R., was not fully realized due to refinery problems. However, the CANOL Projects, with one exception (CANOL No.5) were completed and operational prior to abandonment. With hindsight, CANOL No.1 proved to be unnecessary and today there is still controversy regarding the necessity of all the CANOL Projects. Academic and popular articles present different interpretations

of the events.

CANOL was one of the main joint defense projects in Canada. Yet it remains virtually unknown or, at best, poorly understood by the Canadian public. The negotiations and international agreements governing the CANOL Projects illustrate how wartime decisions were made and the dominant role that the U.S. government had in North American defense.

For nearly two years the U.S. Army had exclusive rights to the hydrocarbon resources of the Yukon and western Northwest Territories (Figure 1.3). Under this agreement, wildcat drilling operations were conducted to delineate the Norman Wells hydrocarbon reservoir. Exclusive geological mapping was completed for a large area in the Mackenzie River Valley.

Various researchers argue that the military, civilian and political personalities involved with CANOL experienced significant alterations in their careers as a result of the project. These included such people as Lieutenant General B. Sommerville, the Commanding General of the Army Service Force; Senator H.S. Truman, Chairman of the Senate Special Committee Investigating the National Defense Program; and G.H. Blanchete, Chief Surveyor for the CANOL Project. For example, it has been argued that Truman's role in the senate hearings of 1942–1943 laid the foundation for his election to the presidency of the United States in 1945.

The impact of the CANOL Project on northwestern Canada is difficult to quantify. Understanding of the northern environment was enhanced even though most of the Project was abandoned in just over three years after its conception. The legacy of CANOL persists today.

1. Landing strips along the Mackenzie River are still in use.
2. The Mackenzie Winter Road is an essential transportation link in the region.
3. The South Canol Road is open year–round and mineral exploration and development north of Ross River has focussed along the North Canol Road (part of the CANOL No.1 corridor).
4. The wells and refinery at Norman Wells have supplied products to the Mackenzie region since 1945.
5. The oil field delineated and tested as part of CANOL will soon be supplying oil and

gas for the 866 km Norman Wells pipeline.

A number of less tangible contributions were also made.

1. Designers and labourers gained construction experience in a northern environment.
2. Practical experience in maintaining and operating the first northern pipeline of this scale was also gained.
3. Engineering practices were developed to cope with construction in ice-bonded permafrost terrain.
4. Geotechnical, geological, botanical and zoological information has been collected through surveys along the route before, during and after abandonment.

2.1.1 Nationally Relevant Historic Themes

The CANOL Project is of significant historical importance to all of Canada, despite its isolated location in northwestern Canada. The reasons for this fall within a number of historical themes (Swannack 1979).

1. CANOL was designed to be a major contribution to continental security as a defense work during World War II and as such spanned the U.S. (Alaska)/Canada (Yukon and B.C.) border and crossed provincial and territorial (Alberta, B.C., N.W.T., Yukon) borders. CANOL was a joint defense project and as such involved a sharing of resources by Canada and the United States in the pursuit of a common goal.
2. CANOL involved Canadian extenal affairs as international treaties and agreements were necessary. Several agreements involving income tax, tariffs, exploration and mineral rights, law enforcement and other areas of concern were developed to meet the special needs of the CANOL Project.
3. As originally conceived, the CANOL Project was a work of military necessity that resulted in the construction of facilities on a scale that remains unparallelled even today (e.g. the Alyesky Pipeline is 1,280 km in length while CANOL No.1 was 930 km long and all of the CANOL pipelines totalled 2,512 in length).
4. CANOL necessitated an extraordinary effort on the part of the U.S. Army, the general contractors and their employees. The great size of the project and the difficulties of supply in a virtually unknown area and environment remain unparallelled in North America. The completion of CANOL and its ancilliary projects

in 13 months (over a 22 month period) remains an achievement that is unrivalled in the North.

5. Despite its ignoble end and the criticism that was levelled at the project, it has had many positive effects in northern Canada. One effect, that is yet to be fully realized, is that it stimulated mineral exploration and the eventual exploitation of these resources in this part of Canada (e.g. the Norman Wells pipeline; several mineral prospects along the Canol Road).

6. CANOL made new areas of northwestern Canada accessible or led to the upgrading of existing transportation facilities. Land (e.g.winter and all weather roads), water (e.g. docking and portage facilities between Fort McMurray and Norman Wells), and air (e.g. landing strips in the Mackenzie Valley) based transportation facilities were all affected.

7. CANOL provided the means and facilities for the first surveying and mapping of much of the region affected. Standard aerial photography (trimetrogon) was flown for the first time in much of this part of northwestern Canada.

8. Little scientific information from the Mackenzie Mountains was available prior to CANOL No.1. The loaction and scale of the project made it possible to conduct biological and geological studies in this, then largely unknown, area of Canada.

9. Significant technological advances were made to cope with the unique limitations of the northern environment. For example, techniques had to be developed for road construction over ice-bonded permafrost. Storage tanks erected on ice-bonded permafrost necessitated special engineering and design. Buildings that could withstand the rigours of the subarctic winters were developed and vehicles capable of transporting supplies were chosen by a process of elimination. Much of the expertise developed was subsequently incorporated into later developments

3. CANOL NO.1 EAST: ITS POTENTIAL AS A NATIONAL HERITAGE TRAIL

3.0.1 Currect Resources

The N.W.T. section of CANOL No.1 is 372 km in length and presently includes 6 pump stations (Plate 3.1) and 8 maintenance camps (Plates 3.2 and 3.3) (Figure 3.1). Between these main camps, isolated emergency shelters can be found approximately every 8 km (Plate 3.4). Big game outfitters utilize two pump stations as base camps and two camps are used for line camps on a regular basis during the late summer and early fall. With the exception of those buildings that have been 'maintained' by outfitters and research parties, all structures are in need of repair. However, there are many buildings in camps that are structurally sound and with a minimum of work (perhaps using materials salvaged on site) could be restored (Plate 3.5).

Examples of many types of structures remain and include: mess halls, living quarters, bath houses, privies, pumphouses (Plate 3.6), generator stations, maintenance garages, parts storage sheds, emergency road shelters, portable camps, aircraft nose hangers, cold-storage lockers and oil storage tanks (Plate 3.7). Many reminders of CANOL can be found along the route and in the camps. Numerous vehicles and parts of vehicles were left on site following the salvage (Plates 3.8 and 3.9) as were sleds (Plate 3.10), pieces of heavy machinery, sections of the pipeline (Plate 3.11) and the telephone line (Plate 3.12), the original mile posts with their markers, signposts (Plate 3.13), and many culverts and bridges in various states of disrepair (Plates 3.14, 3.15, and 3.16). Each camp and many of the emergency shelters (i.e. wanigans or cabooses) still retain a collection of articles following abandonmen These may include shovels, dishes, magazines, stoves, assorted furnishings, tires, oil barrels (Plate 3.17), valves, gauges, bottles, boxes, tins, and posted notices - the 'garbage' remaining after two official and innumerable unofficial salvages.

It is reported that CANOL Museums have been started, in Ross River and in Norman Wells. The number and type of items retained in these collections is not known, however, these could prove a valuable resource when designing interpretive programs. Many published and unpublished books and numerous reports and articles are available documenting CANOL (see Bibliography). Also, many photographs are available through the

Plate 3.1 Pump Station No. 4 lies above timberline in the Bolstead Creek Valley at Mile Post 108E. This camp also has a vehicle maintenance area and a number of truck hulks (photo by Kershaw 1978).

Plate 3.2 Camp 50 on the Little Keele River was a maintenance camp during the Project. Most of the buildings remain sound (photo by Kershaw 1977).

Plate 3.3 Camp 80 was a maintenance camp atop the Plains of Abraham. Several buildings are sound or could be readily reconditioned with materials on site. A large snowblower and a truck are to the right of the road (photo by Kershaw 1979).

Plate 3.4 The Plains of Abraham is well above timberline and supports a healthy Dall's sheep population. There are two wanigans within 2 km of one another near the highest point on the pipeline at 1760 m (photo by Kershaw 1979).

Plate 3.5 Pump Station No. 4 remains in good condition with several of the 'quonset' huts that could be readily reconditioned. It is possible to land with a Helio Courieur just beyond the road (photo by Kershaw 1978).

Plate 3.6 The pumphouse at Station No. 2 has many of the pipes but the pumps have been removed. This is similar to the situation at other pumphouses. Tire chains litter the cement floor (photo by Kershaw 1977).

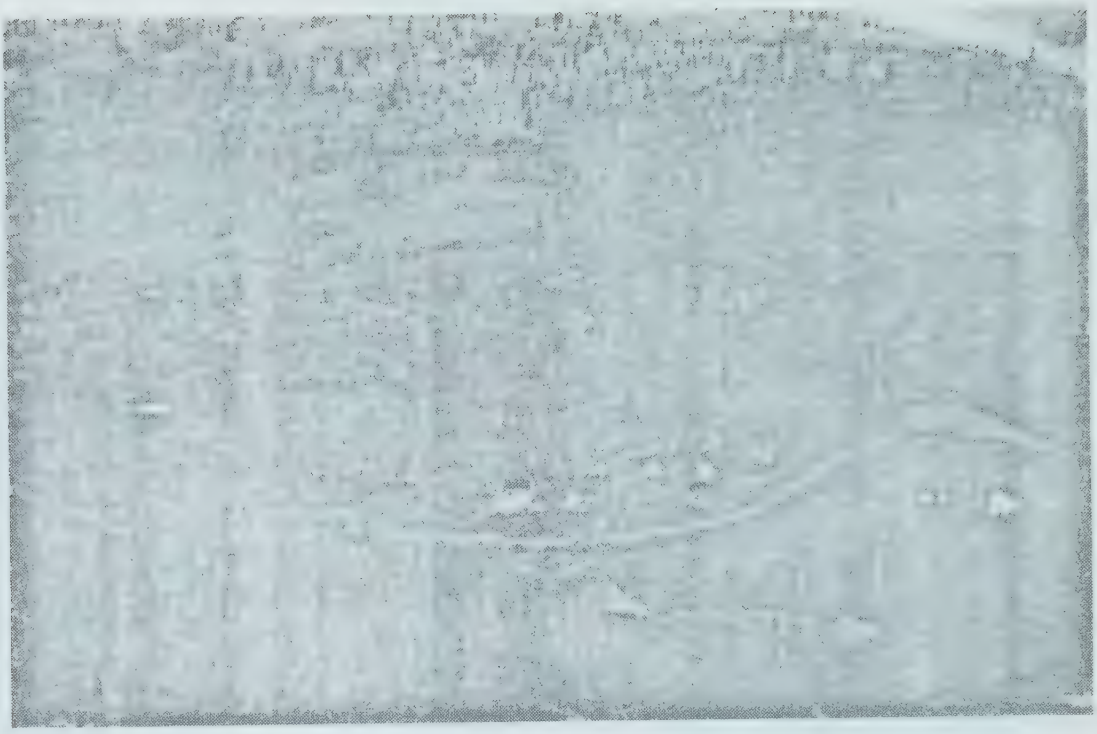


Plate 3.7 Pump Station No. 5 still has the 2000 bbl. storage tank and several buildings needing a minimum of rehabilitation. There are numerous deadlined vehicles in an area nearby. At Mile Post 170E it is within 5 km of a landing strip and float plane sized lake at Godlin Lakes (photo by Kershaw 1977).

Plate 3.8 Most vehicles have the history of their use painted on their doors. This one was originally consigned to the CANOL Project, then to the North West Division convoys and finally used during salvage operations (photo by Kershaw 1979).

Plate 3.9 Solitary vehicles are often found but more commonly they have been left in larger groups (photo by Kershaw 1982).

Plate 3.10 Sleds such as this were dragged behind bulldozers. They carried any of the heavy freight such as pipe, power plants and welding machinery (photo by Kershaw 1977).

Plate 3.11 Where arctic ground squirrels are common, the abandoned sections of the pipeline are occupied (photo by Kershaw 1981).

Plate 3.12 While the telephone poles often remain, often the only evidence of the pipeline are the blocks used to support the pipe during welding. Here on the Mackenzie Mountain Barrens the pipe was completely salvaged out (photo by Kershaw 1977).

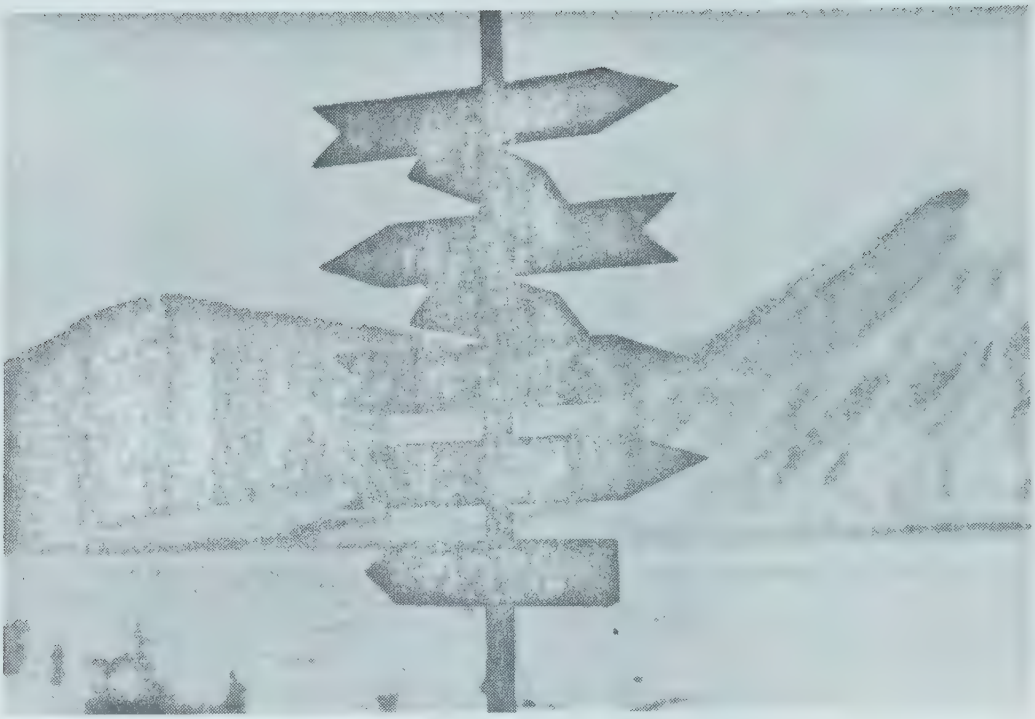


Plate 3.13 This sign post, above the upper Carcajou River, illustrates the isolation of much of the CANOL No. 1 route (photo by R.S. Finnie).

Plate 3.14 The Intga River bridge at Mile Post 204 is no longer useable (photo by Kershaw 1977).

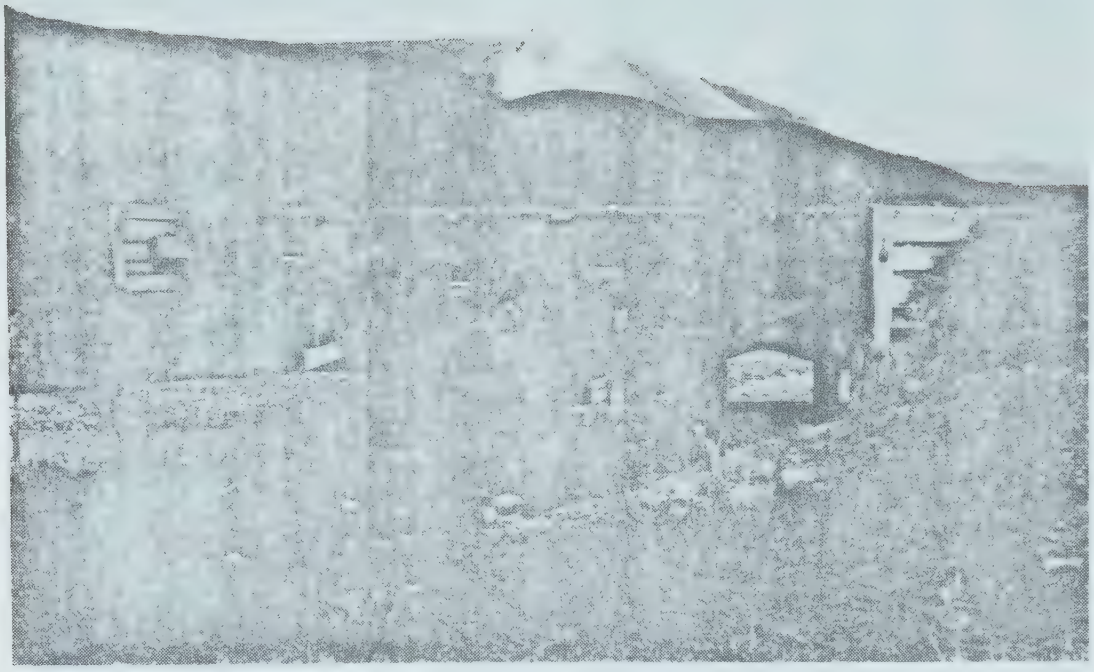
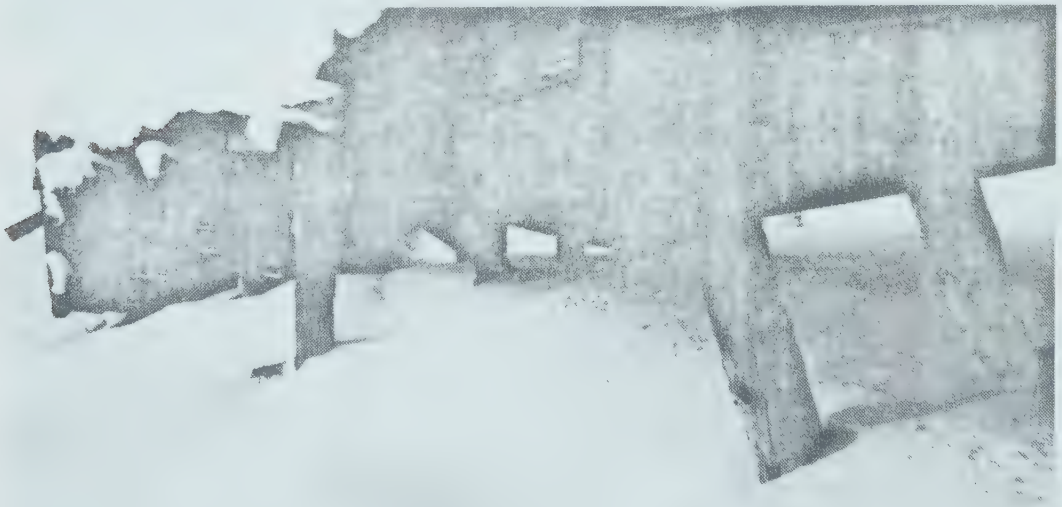


Plate 3.15 Other bridges, such as this one at Mile Post 207.5E are in very good condition (photo by Kershaw 1979).

Plate 3.16 Many bridges such as this one on Borrowman Creek have been damaged by river ice accumulations over the past 39 years (photo by Kershaw 1979).



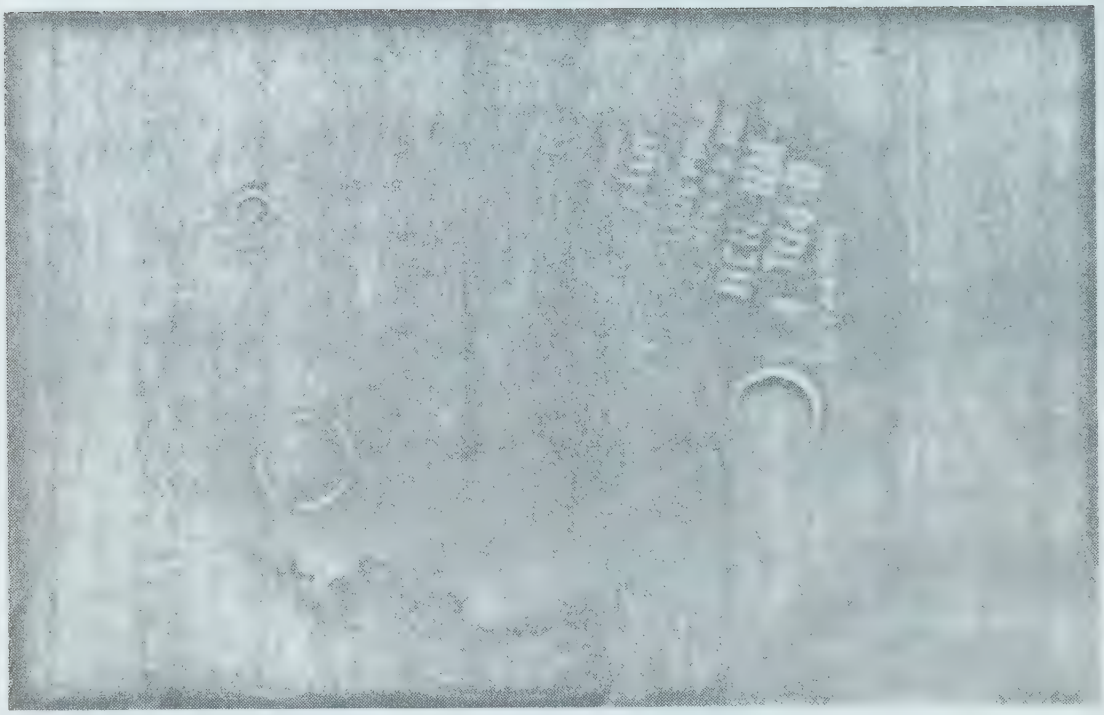


Plate 3.17 As with the vehicles, barrels often retain the record of their history. This one came from California via the Prince Rupert port, then to Skagway, the White Pass Rail Road to Whitehorse and by truck to the N.W.T. section of the CANOL route (photo by Kershaw 1979).

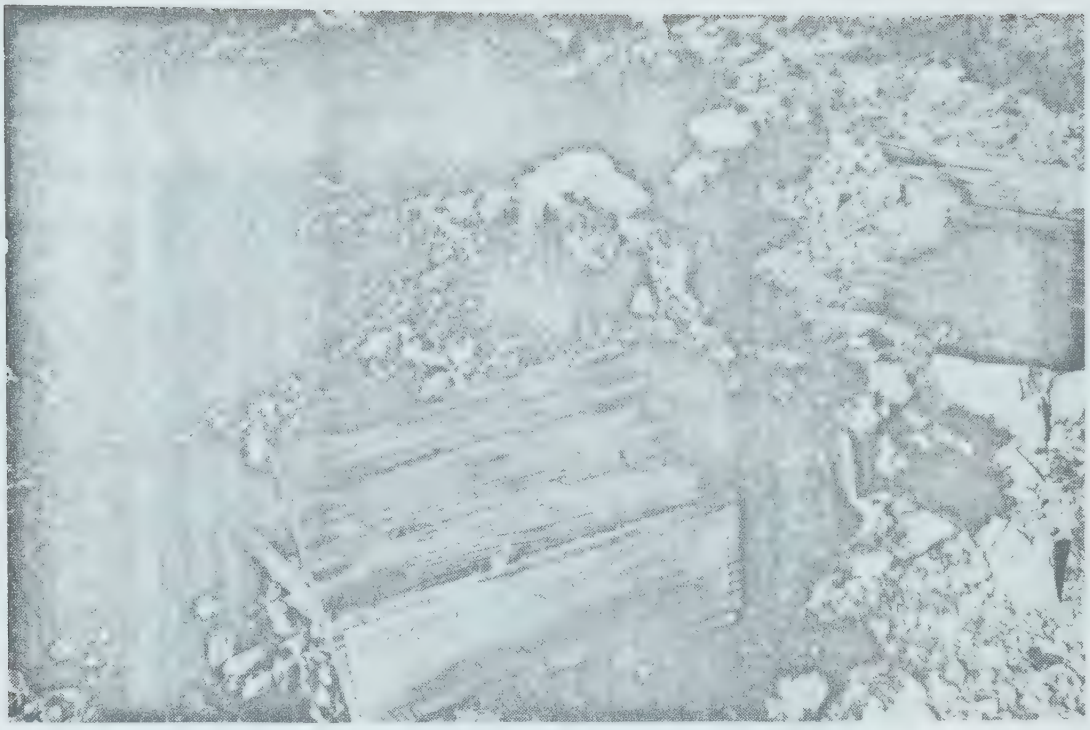


Plate 3.18 Even after 39 years this dynamite box still retains the warning instructions. Up to 20 sticks were employed to blast holes in bedrock and frozen ground for telephone poles (photo by Kershaw 1978).

Plate 3.19 The road provides an ideal hiking and horse trail for much of its length. However, several gaps (some up to 18 km in length) have resulted from river washouts. The buildings along the route provide shelter while the Mile Posts mark one's location (photo by Kershaw 1977).

Plate 3.20 Echo Canyon is but one example of the natural beauty found along the CANOL No. 1E route.

National Museums of Canada, the National Photographic Collection and various private or published sources. R.S. Finnie's collection is the most comprehensive and includes colour slides. Unlike the other sources he provides details on the location, date and subject of the photos. In addition, the quality and coverage is excellent. Of special interest is the colour/sound film (one of the first of its kind), made by R.S. Finnie for the U.S. Army which is now available from several film libraries. This film was a restricted document for 25 years after the war and as a period piece gives the flavour of the political and social environment during the War.

The N.W.T. section of CANOL No.1 is an ideal hiking, snowshoeing/skiing and horse trail (Plate 3.19). The camps and emergency shelters can provide protection during poor weather (especially important above timberline) and are regular points of interest along the trail. The road, when present, offers an elevated, sure-footed pathway for travel. The mile posts provide exact location markers along the route.

Users can gain access in any of several ways. There are lakes that will accomodate float planes and there are landing strips and areas along the route for wheeled aircraft. Regularly scheduled Twin Otter flights service the MacPass air strip which is 14 km west of Macmillan Pass and application has been made to extend this service to the Tsichu River air strip at the old Canol Camp 222 (Figure 1.1 and 3.1). Vehicles can come up the south Canol Road through the Yukon to the western end of the trail and the eastern end is only 6 km across the Mackenzie River from Norman Wells.

Wildlife such as woodland caribou, Dall's sheep, moose, grizzly bear and blackbear are abundant. The route traverses alpine tundra and boreal forest regions where a broad array of natural history themes could be developed.

Current resources include remnants from all phases of the CANOL Project and can be used to illustrate all of the themes mentioned above. The location of these resources in a wilderness environment adds to the attractiveness of the trail (Plate 3.20). Several people hike the CANOL route each year from Macmillan Pass to Norman Wells. These people generally know little about the country and its history except for what they have heard from other hikers or read in brief magazine articles. They have come to the area without any background information since there are no government agencies promoting the region for hiking purposes. Interest in the area as a hiking trail combined

with its national and international historical significance make it an ideal National Heritage Trail with a high potential for the development of an interpretive program.

3.0.2 Public Interest In Northern Pipelines

Public interest in projects relating to pipelines is generally high. Oil and gas pipelines, especially those in the north, are always in the news and will probably be an important component in Canada's future economy. The abandoned CANOL pipeline provides an opportunity to see the first major Northern pipeline and to compare the technology of the World War II era with that of today. In addition many people are concerned about possible environmental i CANOL offers a chance for the public to observe the effects of a major pipeline project, with its associated oil spills, ground ice thawing, vehicle tracks, etc. 40 years after its abandonment.

Since 1970, at least 15 public interest articles have been published about the CANOL Project in the broadly based popular magazines such as Audubon and the Canadian Geographical Journal and in the more specialized journals such as the Northern Engineer, Alaska Magazine and Arctic in Colour. In addition, recent news items on the CANOL Project have appeared in the Edmonton Journal, The Calgary Herald, and the Globe and Mail. It is evident that public interest and concern about Northern pipelines is high. A CANOL Heritage Trail could act to inform Canadians about the history of the Project and at the same time address this concern.

3.0.3 Current Threats

Utilizing the resources on site, it should be possible to reconstruct or stabilize/maintain many of the buildings of CANOL No. 1E or, at the least, retain representatives of the various types of structures. However, if unchecked, the continual erosion of this resource through human activity and the natural processes of decay will eventually destroy most of the remaining facilities. For example, at Pump Station No.3 (R.M.P. 74.5) the Little Keele River has undercut the pumphouse at one point and will eventually wash it away if no remedial measures are taken.

In the Yukon Territory a 'clean-up' of CANOL has removed virtually all of the buillding and camps that formerly existed. The N.W.T. section of CANOL No.1 (excluding

Camp Canol which was virtually demolished in 1974) is the only section remaining somewhat intact. A wildlife lodge with one line camp has recently been constructed utilizing materials from CANOL bridges and camp buildings as well as telephone poles. Above timberline, hunters and hikers have utilized the CANOL Project wood for fires, in some cases dismantling buildings board by board. Souvenirs such as dishes and mile post markers have also been removed by visitors. In many towns (e.g. Whitehorse, Ross River and Norman Wells one can see windows, doors, lengths of cable, beds and buildings, even operating vehicles that have been pieced together from materials removed from CANOL camps.

3.0.4 Closing Statement

CANOL is no longer the property of any one company or group of individuals but belongs to all Canadians (Plate 3.2.1). It was probably the largest World War II project in continental North America and the first major Northern pipeline project. The facilities remaining in the Northwest Territories are historical relics of this moment in Canadian history and should be protected as an important national heritage resource

Plate 3.21 No longer the property of Imperial Oil, the many remnants of the CANOL Project that can be found in the N.W.T. represent a nationally significant historical resource.(photo by Kershaw 1977).

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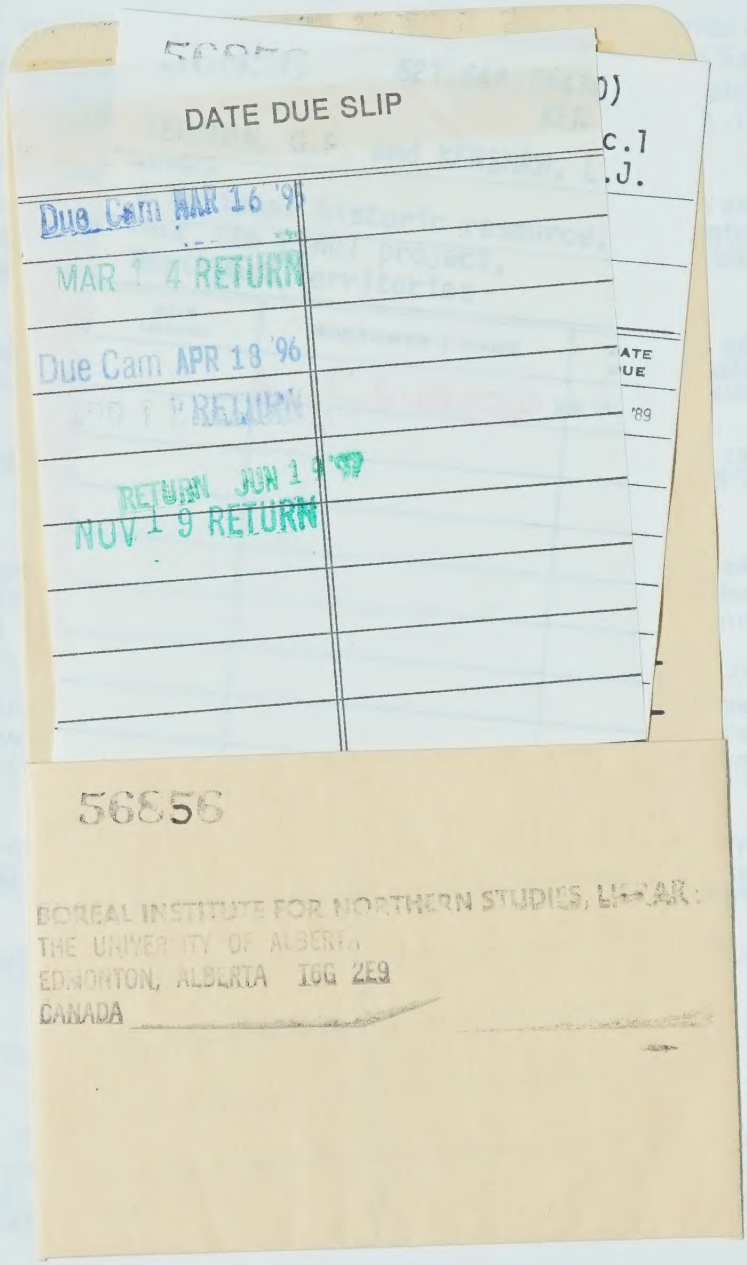
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